Risk Factors for Urinary Incontinence in Taiwanese Women Aged 20–59 Years

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SUMMARY

Objective: To assess the risk factors for urinary incontinence among Taiwanese women.

Materials and Methods: A sample of 4,549 women was selected using a multistage random sampling protocol. The women selected were interviewed face-to-face by well-trained interviewers. The usual risk factors, which included marital status, age, body mass index, menstrual status, alcohol intake, drug allergy, diabetes mellitus, hypertension and gynecologic events, were evaluated. The factors were assessed by frequency analysis and logistic regression analysis using a significance level of less than 0.05.

Results: A total of 3,537 women were successfully interviewed, producing a response rate of 77.8% (3,735/4,549). The prevalence of urinary incontinence increased significantly with marriage (21.7%; 95% confidence interval, CI, 20.2–23.2), alcohol intake (24.9%; 95% CI, 19.3–30.5), drug allergy (24.5%; 95% CI, 19.9–29.2), diabetes mellitus (40.3%; 95% CI, 29.3–51.2), hypertension (30.1%; 95% CI, 23.8–36.4), body mass index (odds ratio, 1.05 per unit increase; 95% CI, 1.02–1.09) and a previous gynecologic operation (25.5%; 95% CI, 19.9–31.2). Age was also a risk factor for urinary incontinence (odds ratio, 1.04; 95% CI, 1.03–1.05), but there was no relationship between urinary incontinence and parity, route of delivery, smoking or menstrual status.

Conclusion: There is a high prevalence of urinary incontinence among women who suffer from diabetes or hypertension, or who have undergone a gynecologic operation, in particular hysterectomy. From a public health viewpoint, it is important to promote better health education in order to improve understanding of urinary incontinence and its risk factors and to increase the awareness of the availability of mainstream treatments. [*Taiwan J Obstet Gynecol* 2008;47(2):197–202]

Key Words: risk factors, Taiwanese women, urinary incontinence

Introduction

The prevalence of urinary incontinence (UI) among Taiwanese women aged between 20 and 59 years is 18.7%, and aging has been shown to have a significant effect on risk with an odds ratio of developing UI being 1.04 [1]. It was estimated that there would be more than one million women aged between 20 and 59 years in Taiwan who had suffered from UI. The quality of life of women with UI is significantly worse than women without UI [2]. This study attempted to determine the importance of aging, previous gynecologic operations, diabetes mellitus (DM), hypertension (HT), body mass index (BMI), and other precipitating factors on the development of UI. Interest in this regard has been stimulated by controversial reports in the literature about the risk factors for UI [3–6].

From a public health viewpoint, it is important to identify the risk factors for UI that might impair the life quality of the sufferers; identification of the risk factors

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will help in the lifestyle behavior modification of women at risk, which will be important to prevent and treat this disorder.

Materials and Methods

The study was conducted in Taiwan, including the main and the small islands within the sovereign territory. There were an estimated 5.9 million women between the ages of 20 and 59 years living in Taiwan. In coordination with the National Institute of Family Planning (NIFP) of the Department of Health, Executive Yuan, Taiwan, and supervised by the Population Studies Center of the University of Michigan, USA, 4,549 women within this age group were selected for a multistage random sample design study. This study was part of the eighth nationwide survey of knowledge, attitudes and practices on family and fertility conducted by the NIFP.

All the survey procedures, including design and draft of questionnaire, pretest and revision, sampling design and operation, recruitment and training of interviewers, interview fieldwork, questionnaire editing and correction, test–retest, and data coding, cleaning and analysis, were arranged by the NIFP. A committee was organized by the NIFP in order to review and approve the protocols for this study. About 100 interviewers attended a 3-day training, which included trainings for standard procedures for conducting interviews, questionnaire contents, and interview-related skills. There was a summary assessment for the interviewers. Only those who were qualified could conduct field interviews.

Within 4 to 6 months of selection, the women selected were interviewed face-to-face in their homes by well-trained professional NIFP interviewers. Because the interviewee had to answer the questionnaire herself, those potential respondents who were identified as severely ill, deaf or hard of hearing, mute, having cognitive disorder, having difficulties in communication, or being too sad to communicate were excluded from the study. This study was fully explained to the participants. The questionnaire was devised to cover five areas: general background, medical history, obstetric and gynecologic history, urinary incontinence, and other lower urinary tract symptoms. The validity of this study was assessed by increasing content validity through incorporating the opinions of the NIFP experts when the questionnaire was designed. UI was considered to be present when a respondent answered "yes" to the question, "Have you experienced involuntary urine loss during daily activities?" Interviewees who did not answer this question were excluded from the study. Analysis of the individual items was based only on the number of subjects who answered particular questions.

All data were entered into a computer database and analyzed using SAS software (SAS Institute, Cary, NC, USA). The χ^2 test was used to test for differences in the percentage of nocturia among participants with different dichotomous explanatory variables. Simple logistic regression models were used as univariate analyses to evaluate the association between nocturia and each concerned variable. Multivariable logistic regression analyses were performed to assess the interaction of independent or dependent variables on the risk for nocturia. To adjust for possible confounders, we dropped out the non-significant variables step-by-step from the multivariable model. Risk was estimated using odds ratio (OR) with 95% confidence interval (CI). A p value of less than 0.05 was regarded as statistically significant.

Results

A total of 3,537 women were successfully interviewed, producing a response rate of 77.8% (3,537/4,549).

The age and BMI distributions of the subjects in this study are listed in Table 1. BMI of the majority of Taiwanese women aged 20–59 years were within normal range, according to the data of the Department of Health, Executive Yuan, Taiwan. Table 2 shows the distribution of age by medical histories and marital status among the participants. It is obvious that the age of each group of interviewees with DM, HT, previous gynecologic operations and the married was on average older than that of the groups without these respective parameters.

Table 3 reveals that the risk of UI significantly increased with DM, HT, previous gynecologic operations, alcohol consumption, drug allergy, and marriage; these factors all showed a significant effect with p values of less than 0.05. In addition, hysterectomy was the highest risk factor among gynecologic operations for UI (Table 4).

Table 1. Age and body mass index (BMI) distributions of the participants

	n	Minimum	Maximum	Mean	Median	SD	SE	95% CI (%)
Age (yr)	3,509	20	59	37.6	37	10.8	0.2	37.2–37.9
BMI	3,275	12.1	39.7	22.2		3.3	3.3	22.1–22.3

SD = standard deviation; SE = standard error; CI = confidence interval.

Table 2. Age distribution by medical histories and marital status of the participants

Group	*n*	Age (yr)					
		Minimum	Maximum	Mean	SD	SE	95% CI (%)
Diabetes mellitus							
No	3,446	20.0	59.9	37.3	10.7	0.2	37.0–37.7
Yes	77	21.2	59.8	48.3	9.1	1.1	46.2–50.3
Hypertension							
No	3,313	20.0	59.9	36.8	10.6	0.2	36.5–37.2
Yes	206	24.7	59.8	49.2	6.9	0.5	48.2–50.2
Gynecologic operation							
No	3,224	20.0	59.9	37.0	10.7	0.2	36.6–37.3
Yes	231	21.2	59.9	44.7	9.3	0.6	43.5–45.9
Drug allergy							
No	3,172	20.0	59.9	37.3	10.7	0.2	36.9–37.7
Yes	326	20.0	59.8	40.1	11.1	0.6	38.9–41.3
Smoking							
No	3,318	20.0	59.9	37.6	10.72	0.19	37.25–37.98
Yes	153	20.0	59.9	36.6	11.53	0.93	34.80–38.46
Alcohol consumption							
No	3,251	20.0	59.9	37.6	10.8	0.2	37.2–38.0
Yes	299	20.0	59.6	37.0	10.6	0.7	35.6–38.3
Married							
No	722	20.0	58.4	26.4	6.7	0.3	25.9–26.9
Yes	2,815	20.2	59.9	40.4	9.7	0.2	40.1–40.8

SD = standard deviation; SE = standard error; CI = confidence interval.

Table 3. Prevalence of urinary incontinence (UI) by medical histories and marital status

Group	UI, *n* (%)	SE (%)	95% CI (%)	χ^2	Degrees of freedom	*p*
Diabetes mellitus						
Yes	31/77 (40.3)	5.6	29.3–51.2	23.925	1	0.000
No	629/3,444 (18.3)	0.7	17.0–19.6			
Hypertension						
Yes	62/206 (30.1)	3.2	23.8–36.4	18.701	1	0.000
No	596/3,313 (18.0)	0.7	16.7–19.3			
Gynecologic operation						
Yes	59/231 (25.5)	2.9	19.9–31.2	7.336	1	0.007
No	591/3,224 (18.8)	0.7	17.0–19.7			
Alcohol consumption						
Yes	57/299 (24.9)	2.9	19.3–30.5	5.972	1	0.015
No	597/3,251(18.4)	0.7	17.0–19.7			
Drug allergy						
Yes	80/326 (24.5)	2.4	19.9–29.2	8.167	1	0.004
No	533/3,172 (18.1)	0.7	16.7–19.4			
Married						
Yes	610/2,815 (21.7)	0.8	20.2–23.2	79.059	1	0.000
No	52/722 (7.2)	1.0	5.3–9.1			

SE = standard error; CI = confidence interval.

Table 4. Prevalence of urinary incontinence (UI) by gynecologic operations

Operation	UI, *n* (%)	SE (%)	95% CI (%)
Hysterectomy	47/148 (30.8)	3.8	24.3–39.3
Oophorectomy	8/81 (9.9)	3.3	3.4–16.4
Hysterectomy + oophorectomy	2/9 (22.22)	13.9	*
Nephrectomy + oophorectomy	0/1 (0)	*	*

**Data were too small to be evaluated. SE = standard error; CI = confidence interval.*

Table 5. Logistic regression for urinary incontinence (UI), age and diabetes mellitus (DM)

Predictor	Coef	SD	Z*	*p*	Odds ratio	95% CI (%)
Constant	−2.887	0.169	−17.08	0.000		
Age	0.036	0.004	8.80	0.000	1.04	1.03–1.05
DM	0.731	0.245	2.98	0.003	2.08	1.28–3.36

**A testing statistic that follows a standard normal distribution under the null hypothesis. Coef = coefficient; SD = standard devation.*

Table 6. Logistic regression for urinary incontinence (UI), age and body mass index (BMI)

Predictor	Coef	SD	Z	*p*	Odds ratio	95% CI (%)
Constant	−3.934	0.319	−12.34	0.000		
Age	0.033	0.005	7.09	0.000	1.03	1.02–1.04
BMI	0.053	0.015	3.64	0.000	1.05	1.02–1.09

Coef = coefficient; SD = standard deviation; CI = confidence interval.

Table 7. Prevalence of urinary incontinence (UI) by menstrual status and smoking status

	UI, *n* (%)	SE (%)	95% CI (%)	χ^2	Degrees of freedom	*p*
Menstruating						
Yes	502/2,750 (18.3)	0.7	16.8–19.7	1.414	1	0.234
No	152/754 (20.2)	1.5	17.3–23.0			
Smoking						
Yes	27/154 (17.5)	3.1	11.5–23.5	0.094	1	0.759
No	626/3,345 (18.7)	0.7	17.4–20.0			

SE = standard error; CI = confidence interval.

In fitting a logistic regression model, a positive relationship was demonstrated between the probability of UI, π (x, y) and age, x, and DM, y, using:

$$\pi(x, y) = \exp(-2.887 + 0.036x + 0.731y) \div [1 + \exp(-2.887 + 0.036x + 0.731y)]$$

where y = 1 (having DM) or 0 (no DM). The logistic regression of the model is shown in Table 5. The odds ratio for age was 1.04 and that for DM was 2.08. Furthermore, the effect of age and DM on the probability of developing UI was multiplicative (odds ratio, 1.04 × 2.08). Similarly, the logistic regression for UI, age and BMI shows that BMI significantly increased the risk of UI (odds ratio, 1.05; $p = 0.000$; Table 6). Besides, age and BMI had a multiplicative effect on the prevalence of UI (odds ratio, 1.03 × 1.05). Table 7 shows that whether or not Taiwanese women aged 20–59 years were still menstruating did not affect the probability of UI in a statistically significant way. Similarly, smoking did not increase the risk of UI in this study.

Discussion

UI is a complex and common condition that may be encountered in women of all ages. The symptoms of UI can cause significantly embarrassing problems in many women. Although it is two to three times more common in women than in men, the etiology of UI is still controversial.

This study showed that age was significantly related to the prevalence of UI [1]. Such a positive association between age and UI has previously been

addressed [7], although Goldberg et al reported a weaker association [8].

With the increasing prevalence of UI in elderly women, it would be beneficial to identify the risk factors associated with the development of this condition. The risk factor identified in this study as most significantly associated with the prevalence of UI was DM. The study by Brown et al [9], which looked at the prevalence of UI in 7,949 community-dwelling women, revealed the same result. As the mean age of the diabetic group was older than that of the non-diabetic group in this study (48.3 *vs.* 37.3 years, respectively), the tendency to develop peripheral neuropathy in DM patients may account for the sequela.

It has been suggested that the development of UI might be related to damage to the innervation of the pelvic floor as well as direct trauma to the endopelvic fascia, levator ani muscle and pelvic diaphragm during vaginal delivery. This study showed that the prevalence of UI was not associated with parity or route of delivery [1]. Some studies drew the same conclusions for parity [8,10], but others found that parity was a risk factor [4,11,12] and that women who had undergone vaginal delivery were more likely to report UI than those who had delivery by cesarean section [4,7,8, 13,14].

Although this study found no significant relationship between UI and increasing parity or route of delivery, it showed that the prevalence of UI increased significantly with previous gynecologic operations, particularly after hysterectomy, even if only a weak association was found for the route of hysterectomy. Several studies have also demonstrated a clear effect of hysterectomy on women in creating a relatively high risk for UI development [5–7,10,11,14,15].

In spite of the mean BMI (22.2 kg/m^2) of this study being within the range of normal or ideal body weight of Taiwanese women, the severity of UI tended to increase with the BMI of women for all ages. Although Peyrat et al [7] and Goldberg et al [8] reported that no relationship was found between UI and obesity, the majority of studies revealed that the risk of UI increased in women with higher BMI [3,10,11,14–16].

Alcohol consumption was shown to be a risk factor for the development of UI in this study. Notably, the mean ages of the group consuming alcohol and that not consuming alcohol were not significantly different. Zambelis et al [17] found that the direct toxic effect of alcohol on peripheral nerve fiber was the main etiologic factor of alcoholic polyneuropathy, and Ammendola et al [18] also showed a higher sensitivity of females towards the toxic effects of ethanol on peripheral nerve fibers. It would seem that peripheral neuropathy due to alcohol consumption might be a cause of the etiologic association between alcohol and the onset of UI. This finding needs confirmation, and the possible mechanism explaining the association also needs further investigation. In fact, Dallosso et al [19] reported that the intake of total fat, saturated fatty acids, monounsaturated fatty acids, zinc and vitamin B12 were all positively associated with UI onset, in a similar manner to alcohol.

Other additional independent risk factors involved in UI in this study were drug allergy and married status. The group with a history of drug allergy had a tendency to develop UI despite that the type of drug causing the allergy was unknown. There was no telling evidence regarding this association, and this also needs further investigation. As age is a risk factor of UI and the mean age of the unmarried was younger than that of the married (26.4 *vs.* 40.4 years), the higher prevalence of UI among married women than unmarried women is thus explained.

A high prevalence of UI was observed among women with DM, HT, a previous gynecologic operation, a history of drug allergy, alcohol consumption and marriage. UI is highly prevalent even in well-functioning older women. The large number of risk factors for UI suggests that there may be a range of different etiologies for UI, and thus, a number of prevention strategies may be needed. From a public health viewpoint, it is important to promote better health education in order to improve understanding of UI and to increase the awareness of the availability of mainstream treatments. In addition, better health education for women will draw their attention to the possibility that surgical treatments such as hysterectomy may be an important cause of UI, and this will lead to pressures to improve current gynecologic surgical techniques in order to make them more effective and safer.

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